

# Use of collections in botanical diversity research

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Nomenclature Committee for Vascular Plants, Chairman

IPS-161 Biological collections

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# Contents

- Botanical documentation: typification and vouchers
- Rules of botanical nomenclature
- Publication of a new species (name)
- Taxonomic hierarchy and classification

Botanical documentation:  
typification and vouchers

# Documenting the research

- Preservation of vouchers: herbarium specimens, liquid preparations, dried fragments in boxes, slides...

Reasons: rich in characters, allow for identification

- No preserved voucher, no documentation: living collections, DNA samples
- Documentation of limited value: photographs



# Vouchering the research



- Vouchers are essential documentation to all biodiversity studies, for verification and reproducibility [phylogeny, phylogeography, taxonomy, floristic inventories, structural morphology]
- Depositing vouchers: botanical museums, archives of research groups, personal archives
- Why archiving? Documentation, verification, accessibility
- What to document? All non-routine studies
- What is a voucher? A preserved plant or any of its parts.

# Typification: basics and procedures

# Botanical nomenclature

- Based on **International Code of Nomenclature for algae, fungi, and plants** [Botanical Nomenclature] (McNeill et al. 2018, “Shenzhen Code”) It means that formation of names at all ranks is governed by the Code.
- Codes of Botanical Nomenclature:
  - Linnaeus, *Philosophia botanica* (1751) **personal**
  - Alphonse de Candolle (*Lois de la nomenclature botanique adoptées par le Congrès international de botanique tenu à Paris en août 1867; ed. 2, 1883*)  
**”best guide”!**
  - Vienna rules (1906) ..... -> [6 years]
  - Shenzhen Code (2018) **binding document!**

# Botanical nomenclature

- Other Codes, not universally adopted:
  - Kew rule (1877)
  - Berlin rules (1897)
  - Otto Kuntze (*Codex brevis maturis*, 1903)
  - American Code (1904/1907)
- Several botanists followed these informal rules
- These rules may have influenced the international Codes published later (e.g., principle of typification)
- These rules may have included widely different principles and practices, which should be considered for better understanding of old research



# Principle of typification

nomenclatural type provides a link between a name and a taxon (e.g. species)

- Originally plant names were interpreted on the basis of descriptions or illustrations
- To avoid doubts and conflicting interpretations, the principle of standard element (type) was introduced
- To avoid technical doubts, type designations must be effected according to a set of very strict rules

# Principle of typification

- Development of the type concept in international rules:

1912: type concept has been introduced to regulate nomenclature of plant genera

1935: “The application of names of taxonomic groups is determined by means of nomenclatural types.”

1956: Type designation is binding for new names in extant plants since 1958

1961: Type designation is binding for new names of all plants at all ranks since 1958

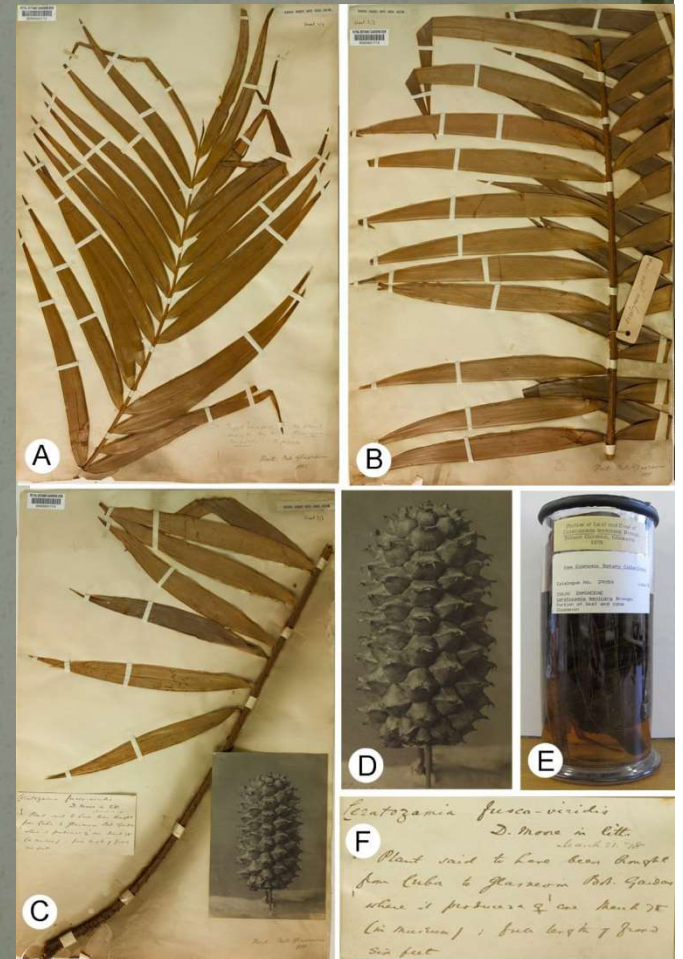
# Principle of typification

- Type elements:
  - preparation: herbarium specimen, parts in a box, liquid preparation, slide, etc.
  - illustration (for new species - only before 2007)
  - morphological description (obsolete, no longer valid)
- Living collections are not eligible for type designation!



# Principle of typification

- What is a specimen? Legal definition:
  - Permanently conserved
  - Made at one time
  - Collected by the same person(s)
  - Collected from a single locality
  - Belongs to a single taxon
  - Preserved in a single preparation (usually but not necessarily)
- Other preparations are not eligible for type designation!



# Herbarium specimen

MUSEUM BOTANICUM UNIVERSITATIS, HELSINKI (H)

*Senecio sylvaticus* L.

FINLAND. Uusimaa (U/N). Porvoo. Island Emäsalo, Varlax, SW part of Råviksmossen, and SW of it.

Ditch bank at the margin of a ditched dwarf-shrub pine bog, and in adjacent forest cut area. Rather abundantly. Spread from the near-by open rocks, where the species is native. With: *Betula pubescens*, *Deschampsia flexuosa*, *Dryopteris carthusiana*, *Galeopsis bifida*, *Luzula pilosa*, *Rubus idaeus*, *Rumex acetosella*. Seed collected for the seed bank and seed exchange of the Finnish Museum of Natural History, University of Helsinki.

WGS84: 61°44.299'N 26°6.66'E Alt. 7 m a.s.l.

13.VIII.2010 Mikko Piirainen 5957, Pirkko Piirainen & Katriina Rautala

- Herbarium label data:
  - Museum
  - scientific name
  - locality
  - ecology
  - date
  - collector
  - number

This label refers to a gathering.  
Gathering is a specimen with all its duplicates.

How to cite that specimen?

# Specimen citation: numbers

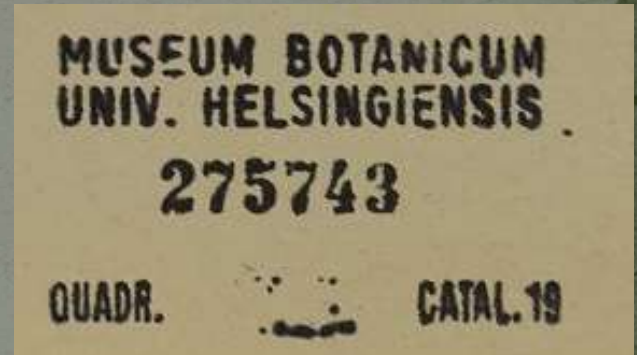
- Assignment of a number makes a specimen easier to recognise
- Assignment of a number makes a specimen easier to cite
- While citing a specimen, it must be assured that numbers are correctly interpreted

# Specimen citation: numbers

- Collector numbers / field numbers (e.g. Piirainen 342) may make distinction between gatherings
- Curatorial numbers (e.g. 342. *Hieracium umbellatum*) may include several gatherings
- Numbers in “exsiccata” published and widely distributed specimens
- Herbarium accession numbers make distinction between herbarium sheets
- Barcode numbers invented for imaging and databasing; may correspond (but not necessarily) to accession numbers

# Specimen citation: current standards

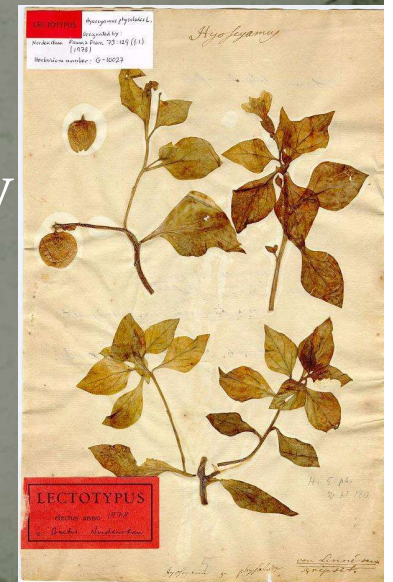
- label data in full
- collector's name:  
21.06.1978, *Ranta s.n.*
- name and number: *Piirainen 241*
- curatorial number: *Wallich Catalogue 4552*
- number in exsiccata:  
*Lindberg s.n.* [Herbarium Florae Fennicae 243]
- accession number: *Piirainen 241* (H 275743)
- barcode number: *Solomon 4562* (MO 675543, barcode MO00789966)
- permanent identifier: <http://id.luomus.fi/H.275743>





# Types

- Type – a reference element (specimen or illustration), designated by the original author or a later researcher [or the only specimen that originally existed]
- There are strict procedures and conditions to establish the type.
- Errors in these procedures may be critical and may lead to
  - the need to make the type designation anew
  - to publish the plant name again.



# Categories of type specimens

- Holotype – a specimen [illustration] designated, or the only specimen [illustration] used by the author
- Isotype – a duplicate of the holotype
- Paratype – another specimen cited by the author
- Syntype – a specimen cited by the author
- Lectotype – designated in the absence of a holotype, original material present
- Neotype – designated in the absence of a holotype, original material absent
- Epitype – supporting type, when the type is ambiguous
- Original material – all authentic specimens, of high scientific and curatorial value

# Difficulties in typification and vouchering

- Illustration may serve as a type but prior to 2007; then it must be a specimen.
- Microscopic algae or microfungi still may have illustrations as types if specimen preservation is difficult or impossible.
- Fungi detected in soil samples: DNA sequences were proposed as types but the proposal failed.
- Specimens are considered best representatives of the taxon (preferred over illustrations), and vouchers are indispensable in any study.

# Effective type designation

- In order to be effective, a type designation must:
  - be effectively published (must appear in print)
  - include a direct citation of the type specimen
  - nowadays, include the term “type” [and the statement “designated here”].
- “Direct” does not mean full and complete; a specimen should be unambiguously referred to. But how?  
by locality / date / collector / number

# Rules of botanical nomenclature

- Are summarised in the *International Code of Nomenclature for algae, fungi, and plants*.
- The Code is a binding document by international convention
- The Code is updated every 6 years, at the International Botanical Congress.
- Every next edition of the Code supersedes the previous edition.
- The rules are retroactive unless specifically limited.
- The latest Code is *Shenzhen Code* (June 2018).

INTERNATIONAL CODE OF  
NOMENCLATURE  
FOR  
ALGAE, FUNGI, AND PLANTS  
(SHENZHEN CODE)  
2018



# Rules of botanical nomenclature

- *International Code of Nomenclature for algae, fungi, and plants* is available online in English at <https://www.iapt-taxon.org/nomen/main.php>
- The rules of botanical nomenclature are being translated into several languages, some may be available online.
- The rules are common for plants, fungi and algae but may differ in details according to the nature of the object and the history of its studies.
- **Botanical nomenclature is independent from ZooCode.** Cultivated plants (cultivars) are covered separately (International Code of Nomenclature for Cultivated Plants).

# Purposes of the rules

- Creation of new plant names (how to publish a name)
- Evaluation of previously published names (according to or against the rules; some old names are rejected at this stage because of invalid publication or illegitimacy)
- Choosing the only correct name for the classification (application of names according to the types, priority)

# Application of the Code(s)

- Taxonomy-dependent:
  - Spiraea 'Grefsheim' (cultivar) -> Code of cult. pl.
  - Spiraea x grefsheimii Tzvelev (hybrid) -> ICN
  - Spiraea grefsheimii Tzvelev (species) -> ICN
- Codes are regulating formation and publication of 'plant' names, not taxonomy
- A plant may have more than one correct name depending on a treatment, but only one name may be correct at one time



# Botanical nomenclature and collections

- Rules of botanical nomenclature are frequently updated.
- Nomenclatural status of type specimens may change if the rules have changed.  
[procedures; definition of original material]
- Updates may be needed in taxonomic treatments, type designations and collections.

# Botanical nomenclature: special cases

- Vascular plants (main course)
- Fungi (special subset of 'fungal-only' rules), algae, mosses
- Fossil organisms (special provisions regarding specimens)
- Ambiregna organisms [some protists]  
competitively governed by botanical and zoological Codes, both taking into account the rules of each other

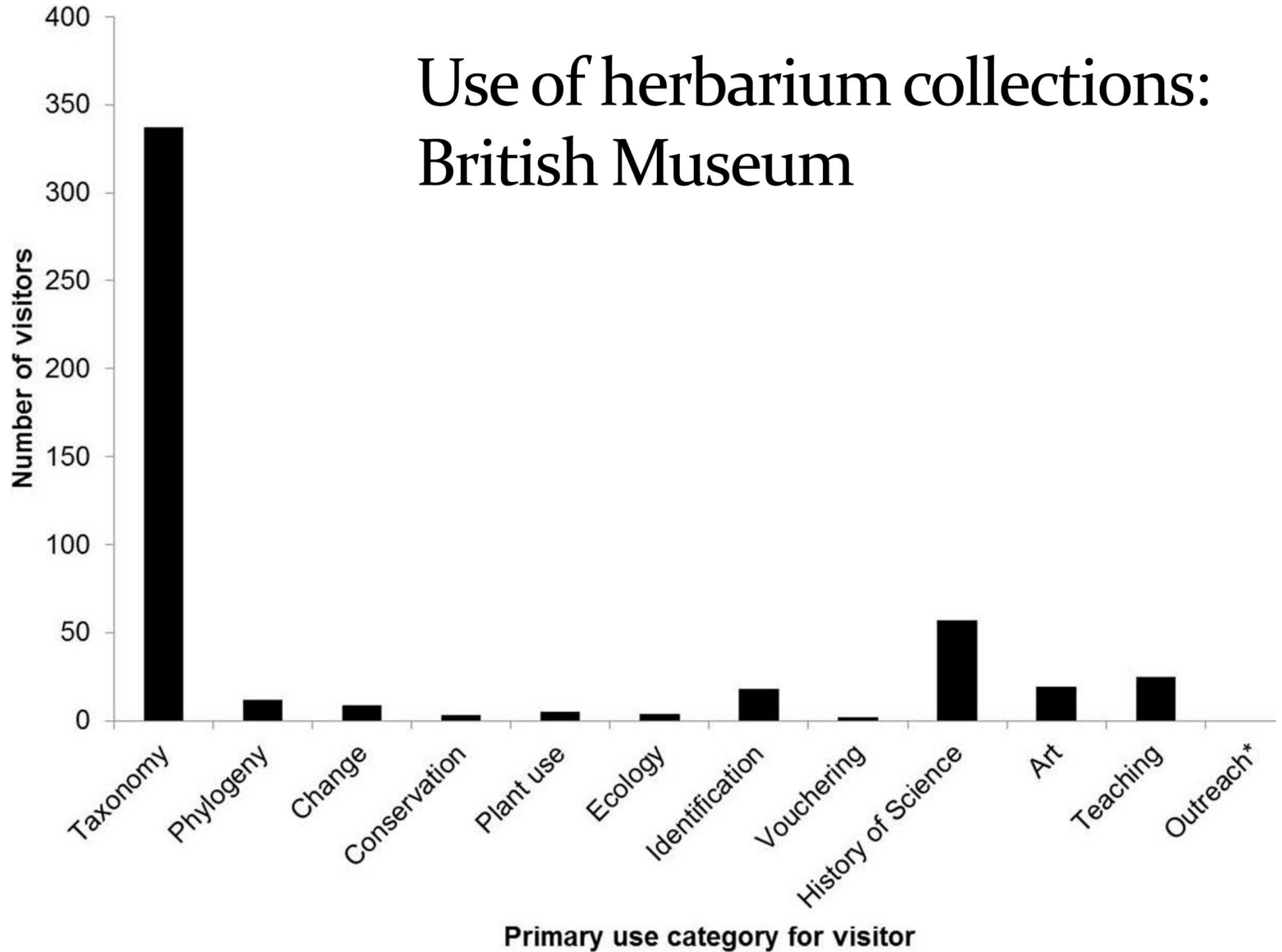
# Collections in taxonomic research

- Description of a new species / subspecies
- Taxonomic and nomenclatural revision of a genus / section / species [alpha-taxonomy, inventory of biodiversity, collection-based research]
- Phylogenetic revision, classification and taxonomy of a genus / section / species
- Genomic studies, evolution of traits
- History of botany

# Kinds of collections used

- Herbarium specimens (taxonomy, phylogeny, inventory) – use with caution, check identifications
- Living collections, botanical gardens (taxonomy, phylogeny) – use with caution, vouchers required
- Field (tissue) samples (taxonomy, phylogeny, genetics) – documentation / vouchers required
- Vouchers = herbarium specimens or equivalent preparations

# Use of herbarium collections: British Museum



# Inventories of specimens

- Herbarium databases (local -> global, GBIF)
- Catalogues of type specimens (JSTOR Plants)
- Catalogues of plant names (International Plant Name Index; online) – nomenclatural backbone
- Catalogues of plant classifications (Catalogue of Life; Plants of the World online) – taxonomic backbone

# Publication of a new species name

In order to be validly published, a species name:

- Must be in Latin (or treated as Latin)
- Must be accompanied with the species description (or a full and direct reference to a species description) [in Latin after 1935, also in English after 2011]
- Must be accompanied with a type designation (1958)
- Must be effectively published  
(in print: in scientific literature, exclusions specified;  
online: since 2012, pdf only, ISSN or ISBN mandatory)

Other information is considered irrelevant to nomenclature

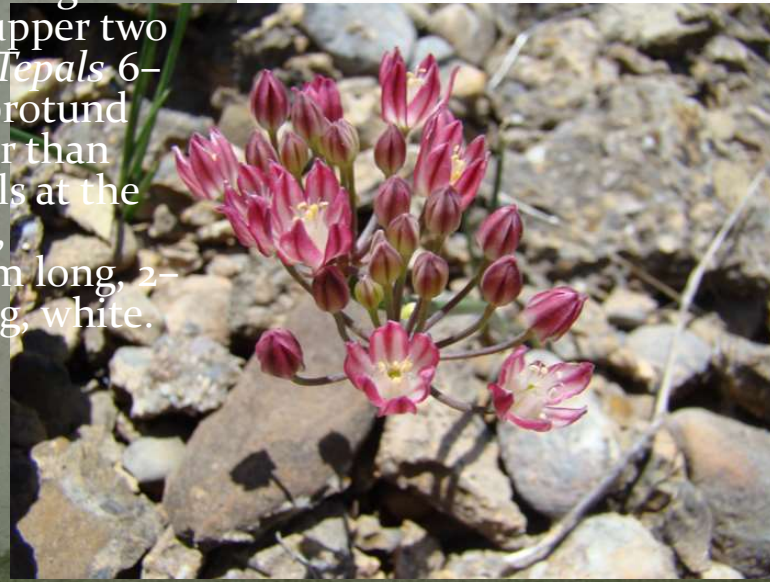
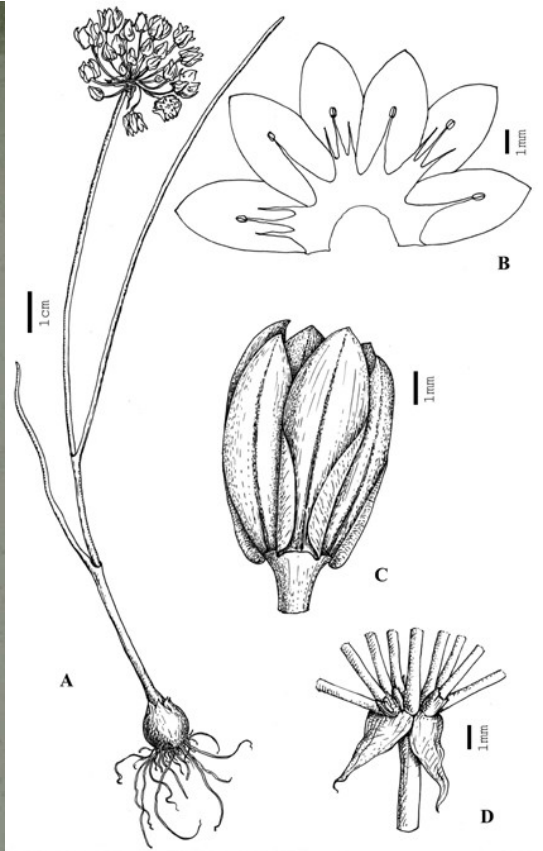
# Publication of a new species (protologue)

- ***Allium formosum*** Sennikov & Lazkov, **sp. nov.** (*Allium* sect. *Spathulata* F.O.Khass. & R.M.Fritsch)
- Fig. 1
- *Ab Allio spathulato statura majore (caulibus ad 30 cm, nec ad 20 cm altis), spathulis brevioribus paucioribus, floribus pluris (ad 30, nec ad 20), tepalis obscuriore roseolo-purpureis, longioribus (6–7.5 mm, nec 4–5.5 mm longis) latioribusque (2–2.5 mm, nec 2 mm latis), apice obtusioribus (nec acutis) basi subrotundis (nec distincte angustatis) differt.*
- **Type.** Kyrgyzstan. Babash-Ata Range: Kara-Köl River valley, left riverside, alt. 1650 m, 41.53° N, 72.68° E, 14.07.2010, A. Sennikov & G. Lazkov 132 (H 1750496, holotype; isotypes FRU, H 1750497).
- **Description.** Bulbs subglobose, 7–8 mm in diameter, ca. 8 mm long, inner tunics slightly violaceous, very thin, transparent, papyraceous, with several longitudinal nerves, outer ones light-grey, decomposing. Bulblets missing. Scape single, 20–25 (30) cm long, up to 1.5 mm in diameter, solid, dark green with a slight purple tint at the base. Leaves 2(3), linear, not exceeding the stems, upright, with the blade up to 20 cm long, ca. 1.5 mm wide, round-appressed and fistulose in the section, dark green, glabrous, with sheaths up to 10 cm long. Spathe membranous, completely divided into two elongate valves 4–6 mm long, reflexed. Inflorescence hemisphaerical, rather lax, with 7–30 developed flowers and ca. 5 abortive buds; pedicels thin, basally thickened, straight, dark-green, of the same length, ca. 1.5 cm long, some of them being embraced in narrow spathules ca. 1 mm long. Perianth cupuliform, intensively pinkish-purpureous in the upper two thirds, basally whitish, with dark-purpureous median veins. Tepals 6–7.5 mm long, 2–2.5 mm wide, oblong, obtuse at the apex, subrotund and only very slightly narrowed to the base. Filaments shorter than tepals, 2.5–3 mm long, white, connected and fused with sepals at the base, outer ones with the triangular base, inner ones broader, tricuspidate. Anthers ca. 0.4 mm long, yellow. Ovary ca. 2 mm long, 2–2.5 mm in diameter, subglobular. Style slightly over 1 mm long, white. Capsule and seeds not known.
- **Phenology.** Flowering in July, fruiting unknown.
- **Ecology.** The species occurs in the low-altitude forest zone (altitudes of ca. 1600–1700 m) in river valleys, on open sunny slopes with sparse savannoid vegetation, sheltered by stones. The plants grow clustered in small patches, suggesting the most successful establishment nearby mature plants (vegetative reproduction is not known in this section).
- **Distribution.** Possibly a narrow endemic of Babash-Ata Mt. Range, Kyrgyzstan (Fig. 3), so far known from the type locality only.
- **Proposed conservation status.** The distribution area of this species is like those of other local endemics of the mountains east of Fergana Valley. A single locality is known, where ca. 10 clusters of flowering plants were noticed. Even though no immediate threat was observed, the area is in active use, first of all for grazing and mining. For this reason and because of the very limited distribution area and a small size of the only population known to date (criterion D: population size estimated to number fewer than 250 mature individuals), this taxon may be recommended for protection as Endangered (IUCN 2001).
- **Etymology.** The new species is named because of its elegant habit and beautiful colouration of the perianth, transitional between deeply pink and purple; Lat. *formosum* = beautiful.



# Description

**Description.** *Bulbs* subglobose, 7–8 mm in diameter, ca. 8 mm long, inner tunics slightly violaceous, very thin, transparent, papyraceous, with several longitudinal nerves, outer ones light-grey, decomposing. *Bulblets* missing. *Scape* single, 20–25 (30) cm long, up to 1.5 mm in diameter, solid, dark green with a slight purple tint at the base. *Leaves* 2(3), linear, not exceeding the stems, upright, with the blade up to 20 cm long, ca. 1.5 mm wide, round-appressed and fistulose in the section, dark green, glabrous, with sheaths up to 10 cm long. *Spathe* membranous, completely divided into two elongate valves 4–6 mm long, reflexed. *Inflorescence* hemisphaerical, rather lax, with 7–30 developed flowers and ca. 5 abortive buds; pedicels thin, basally thickened, straight, dark-green, of the same length, ca. 1.5 cm long, some of them being embraced in narrow spathules ca. 1 mm long. *Perianth* cupuliform, intensively pinkish-purpleous in the upper two thirds, basally whitish, with dark-purpleous median veins. *Tepals* 6–7.5 mm long, 2–2.5 mm wide, oblong, obtuse at the apex, subrotund and only very slightly narrowed to the base. *Filaments* shorter than tepals, 2.5–3 mm long, white, connected and fused with sepals at the base, outer ones with the triangular base, inner ones broader, tricuspidate. *Anthers* ca. 0.4 mm long, yellow. *Ovary* ca. 2 mm long, 2–2.5 mm in diameter, subglobular. *Style* slightly over 1 mm long, white. *Capsule* and *seeds* not known.



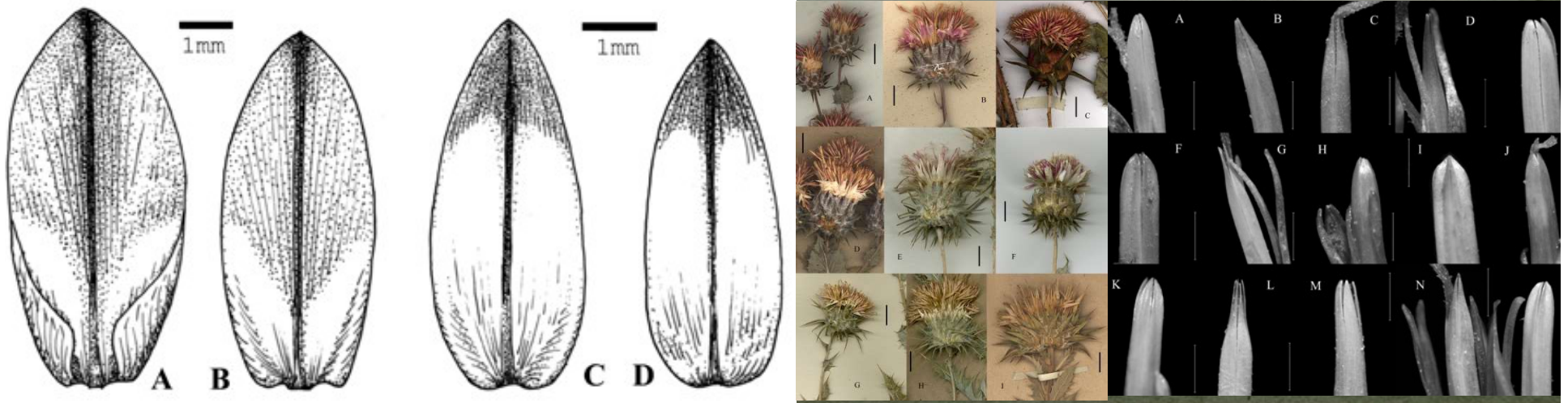
Should be comprehensive, comparable, structured

# Diagnosis (text)

- *Ab Allio spathulato statura majore* (caulibus ad 30 cm, nec ad 20 cm altis), spathulis brevioribus paucioribus, floribus pluris (ad 30, nec ad 20), tepalis obscuriore roseolo-purpureis, longioribus (6–7.5 mm, nec 4–5.5 mm longis) latioribusque (2–2.5 mm, nec 2 mm latis), apice obtusioribus (nec acutis) basi subrotundis (nec distincte angustatis) differt.

Should be concise, informative, laconic;

Any character may be used as diagnostic



# Diagnosis (identification key)

1. Plants up to 20 cm tall. Tepals narrowly oblong, 4–5.5 mm long, 2 mm wide, acute at the apex and narrowed to the base, pinkish in the upper third  
– *Allium spathulatum*
- + Plants up to 30 cm tall. Tepals oblong, 6–7.5 mm long, 2–2.5 mm wide, obtuse at the apex, subrotund and very slightly narrowed to the base, intensely pinkish-purple in the upper two thirds  
– *Allium formosum*

Identification keys preferably reflect taxonomic classification but may be entirely artificial (based on “easy” characters)

Characters are strictly diagnostic and compatible

# Diagnosis (comparative tables)

Tables are used to compare multiple taxa; characters may be not strictly diagnostic

species	<i>E. saurica</i>	<i>E. irgisensis</i>	<i>E. andrachnoides</i>	<i>E. undulata</i>	<i>E. buhsei</i>	<i>E. oidorhiza</i>	<i>E. talassica</i>
height	up to 20 cm	up to 25 cm	up to 20 cm	10--20 cm	up to 80 cm	20--25 cm	10--25 cm
rootstock	rhizomatous, thin	vertical taproot	vertical taproot	vertical taproot	vertical taproot	vertical taproot	rhizomatous, thin
stems	herbaceous, little branched	herbaceous, rather highly branched	herbaceous, moderately branched	herbaceous, little branched	lignified, highly branched	herbaceous, moderately branched	herbaceous, little branched
stem pubescence	very short and dense	short and dense	present or absent	absent	present or absent	short and dense	absent
sterile stems or branches	sterile stems not overtopping inflorescence	sterile stems absent; sterile branches not overtopping inflorescence	sterile stems usually overtopping inflorescence	sterile stems not overtopping inflorescence	sterile stems absent; sterile branches overtopping inflorescence	sterile stems absent; sterile branches not overtopping inflorescence	sterile stems not overtopping inflorescence
leaf length	up to 2.5 cm	0.8--2.1 cm	0.7--2.2 cm	0.7--2.2 cm	0.7--1.8 cm	1.8--2.5 cm	0.8--2 cm
leaf width	up to 1.2 cm	0.5--1.5 cm	0.3--1 cm	0.3--0.8 cm	0.3--0.8 cm	0.4--0.7 cm	0.4--0.9 cm
leaf shape (broader part)	elliptic to ovate-elliptic (middle part)	broadly ovate, oblong-lanceolate or obovate (middle part)	ovate-triangular or oblong-ovate (basal part)	oblong, oblong-elliptic (middle part)	narrowly ovate-lanceolate (basal part)	lanceolate or elliptic-lanceolate (basal part)	ovate, obovate, elliptic (middle part)
leaf texture	incrassate	thin	coriaceous	incrassate, undulate	[unknown]	[unknown]	incrassate
leaf base	rotund	rotund	profoundly cordate, semialexicaul	rotund or broadly cuneate	rotund	cuneate to subrotund	rotund
leaf pubescence	shortly pubescent	shortly pubescent	glabrous or pubescent	glabrous	glabrous or ciliate	glabrous, margin shortly ciliate	mostly glabrous, few hairs at base
pseudumbel	cymes 8--10, dichotomous	cymes 4--6, dichotomous	cymes 7--10, dichotomous	cymes 3--5, dichotomous	cymes 4--5, dichotomous	cymes 2--4, dichotomous	cymes 4--6, dichotomous
cyathial glands	appendages crescent-shaped, 2-horned; horns prominent, apically dilatate	appendages crescent-shaped, sometimes cristate, 2-horned; horns prominent or reduced	appendages crescent-shaped, 2-horned; horns short, apically acute	appendages crescent-shaped, indistinctly 2-horned; horns very short or abortive	appendages crescent-shaped, 2-horned; horns short, apically blunt	appendages crescent-shaped, 2 horned; horns very short	appendages crescent-shaped, 2-horned; horns long and thin
fruit pubescence	shortly pubescent	glabrous	glabrous or ciliate	glabrous	glabrous or ciliate	glabrous	glabrous

# Type statement

- **Type.** Kyrgyzstan. Babash-Ata Range: Kara-Köl River ravine, left riverside, alt. 1650 m, 41.53° N, 72.68° E, 14.07.2010, A. Sennikov & G. Lazkov 132 (H 1750496, holotype; isotypes FRU, H 1750497).

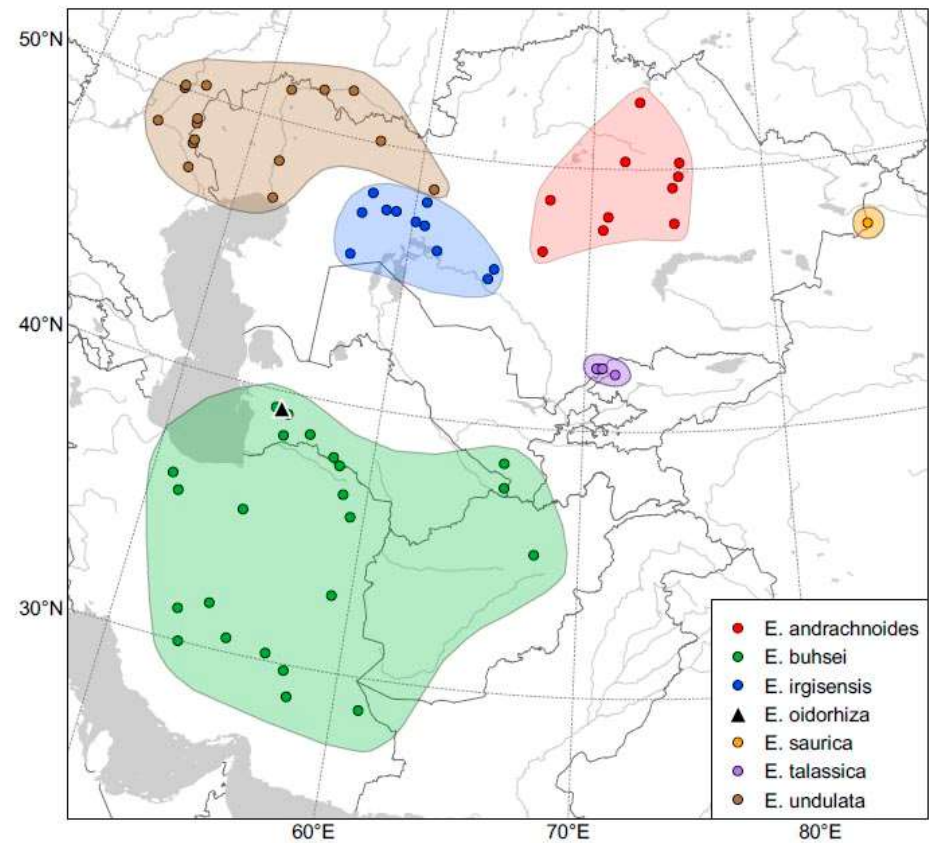
Type (vascular plants) is always a specimen: well-prepared and representative, but not necessarily typical of the species



# Distribution

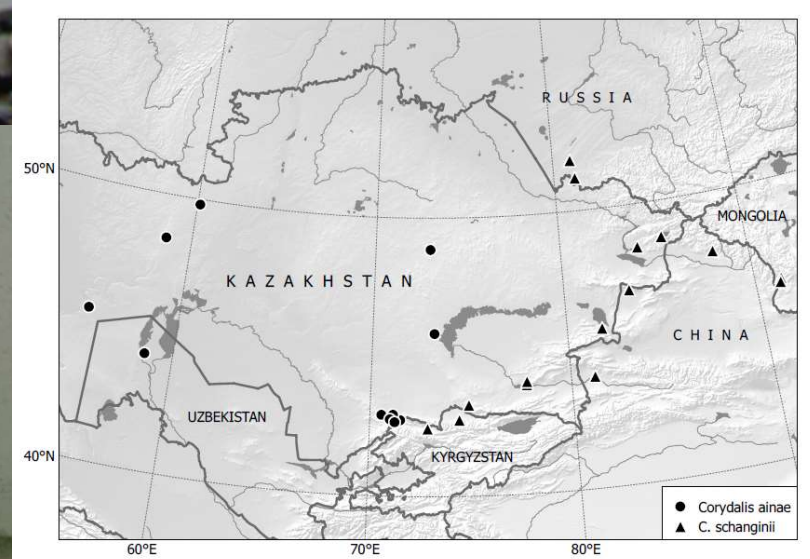


Based on:  
historical specimens,  
recent field collections,  
field observations (now up to 50-70%)  
("New carnivorous plant found on Facebook")





*Corydalis schanginii* (pink)  
*Corydalis ainae* (yellow)  
can be reliably separated by flower colour only, vouchered by photo



# Taxonomic revision

All available herbarium collections

Index Herbariorum

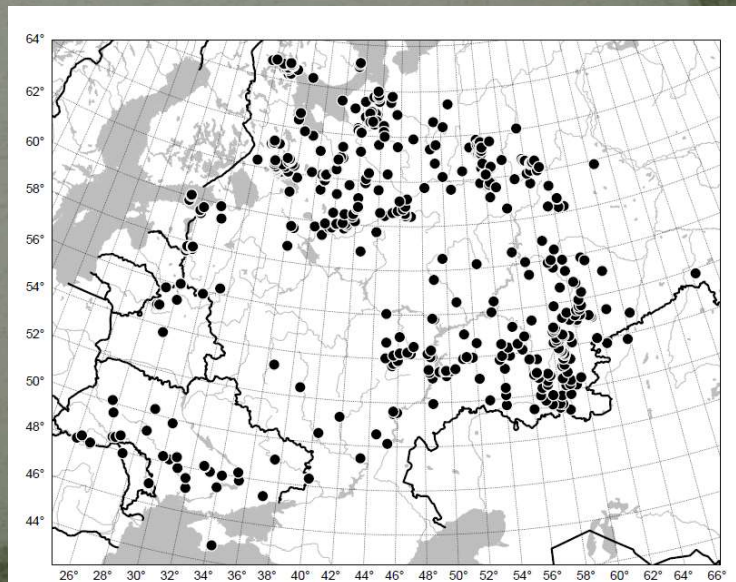
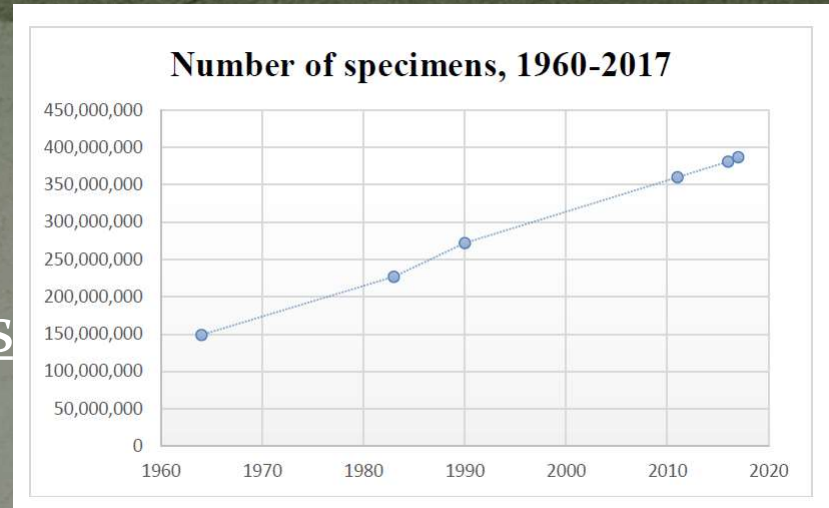
<http://sweetgum.nybg.org/science/ih/>

“As of December 1, 2017, there are 3,001 active herbaria in the world”

“The world's herbaria contain an estimated 387,007,790 specimens”

Global annual increase – 6,000,000 specimens

The primary basis  
for taxonomic work,  
the main guide  
for phylogenetic work





# Protologue (E.Regel, 1877): analysis

## 1. *Allium talassicum* Rgl.

Bulbis oblongo-cylindricis, rhizomati oblique descendenti insidentibus, aggregatis: tunicis fuscis, nervis parallelis demum prominentibus instructis, integris v. apice plus minus laciniatis; caule erecto, tenui, tereti, laevi, supra medium foliato; foliis semitereti-filiformibus, margine sub lente tenuissime serrulato-scabris, caeterum vaginisque glabris, caulem subaequantibus v. superantibus; spatha umbellam aequante usque triplo superante; umbella capsulifera, multiflora, hemisphaerica; pedicellis subaequalibus, perigonium paullo superantibus, omnibus rectis, basi bracteolatis; sepalis elliptico-lanceolatis, acutis; filamentis simplicibus, e basi paullo latiore subulatis, sepala aequantibus, basi inter se breviter connatis; ovario subgloboso; stylo stamina vix superante.

Bulborum tunicae exteriores saturate fuscae, nervis parallelis prominentibus pallidioribus notatae, interiores fusco-stramineae. Caules 15—25 Cm. alti. Folia supra canaliculata. Spatha univalvis, e basi latiore membranacea integra v. vix bifida in rostrum subulatum attenuata. Pedicelli 4—5 Mm. longi. Sepala  $3\frac{1}{2}$ —4 Mm. longa, alba, nervo medio viridi instructa, Ovarium ovato-subglobosum (nec angulatum).

Affine *A. subgloboso*, facile autem dignoscitur «staminibus perigonium aequantibus (nec sesqui-duplo superantibus), caule supra medium (nec infra medium) foliato, spatha univalvi (nec bivalvi), sepalis albis nervo viridi notatis, ovario ovato-subgloboso (nec acute trigono)».

In Turkestaniae montibus alatavicis Kara-Tschok in valle fluvii Talas legit A. Regel.

name

description  
(essential characters)

description  
(extra characters)

diagnosis

provenance, collector (“type”)



# Analysis of the “type citation”

In Turkestaniae montibus alatavicis Kara-Tschok in valle fluvii Talas legit A.Regel.



Kyrgyzstan. Orto-Too Mts.,  
29.08.1876, A. Regel (LE)  
(Lipsky 1905)

**Regel, [Johann] Albert von** (1845-1908), Swiss-born Russian physician and botanist at St. Petersburg, explorer of Turkestan and Eastern Asia 1876-1888; oldest son of E.A. von Regel. (*A. Regel*).

HERBARIUM and TYPES: LE; duplicates in B, BM, BR, E, FI, GOET, H, K, MW, NY, PC, W. – Some duplicates distributed as *Iter turkestanicum*.

Stafleu & Cowan,  
“Taxonomic literature”

# Erroneous interpretations

*Echinops latifolius*  
Tausch (1828)

11. *Echinops latifolius*: capitulis globosis, foliis pinnatifidis arachnoideis subtus cano-tomentosis, laciniis oblongis planis angulato-incisis se invicem attingentibus.

*E. caule sub 1-floro, foliis duplicato-pinnatifidis, foliolis latiusculis vicinis. Gmel. sib. 2. p. 100.*

*H. in Sibiria. 4.*



The presumed type:

*Echinops latifolius*  
Russia, Siberia, 1740s,  
Johann Gmelin

The actual type (PR):

*Echinops sphaerocephalus*  
Europe, Stuttgart  
Botanical Garden, 1760s  
Alexander Martini



# Holotype designation

- In protologue only
- Strictly required for new taxa since 1958 (but conditions varied)
- Strict requirements to the procedure of type designation (effectively published, type stated, specimen directly cited)
- For macro-plants and fungi, specimens only since 2007 (illustrations allowed before 2007); for fossil taxa, only specimens ever

# Lectotypification

- Required when no original type was designated, or the taxon was based on more than one specimen
- Original material is in existence (specimens in collections, published or unpublished illustrations)  
Original material = specimens or illustrations designated or used by the original author
- Strict requirements to the procedure of type designation (effectively published, type stated, intention stated, specimen directly cited)
- Specimen or illustration

# Neotypification

- Required when no original type was designated, or the designated type was lost
- Original material is not in existence (specimens in collections, unpublished illustrations)  
Original material = specimens or illustrations designated or used by the original author
- Strict requirements to the procedure of type designation (effectively published, type stated, intention stated, specimen directly cited)
- Specimen or illustration

# Epitypification

- Required when the original type, or lectotype, or neotype is demonstrably ambiguous (cannot be satisfactorily identified)
- Previously designated type exists  
[Epitype is a supporting type]
- Strict requirements to the procedure of type designation (effectively published, type stated, intention stated, specimen directly cited)
- Specimen or illustration

# Taxonomic synonymy

“Application of plant names is determined by nomenclatural types.”

*Allium kokanicum* Regel in Acta Horti Petropolit. 3: 104 (1875)

Type: Kyrgyzstan. Between Langar and Tengiz-bay, 1869, O. Fedtschenko (LE, holotype).

= *Allium caricoides* Regel in Acta Horti Petropolit. 6: 552 (1880)

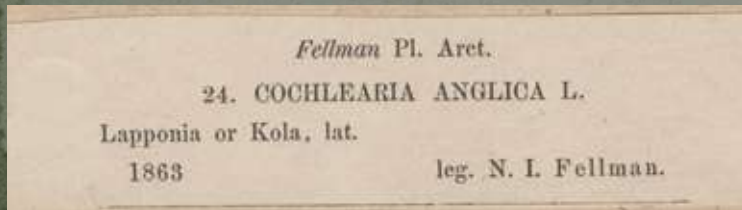
Type: Kazakhstan. Wernoje, Almatinka minor, 06.1877, Fetissow (LE, holotype).

= *Allium hoeltzeri* Regel in Acta Horti Petropolit. 8: 657 (1884)

Type: Ex Horto botanico Petropolitano, 05.1884, E. Regel (LE, holotype).

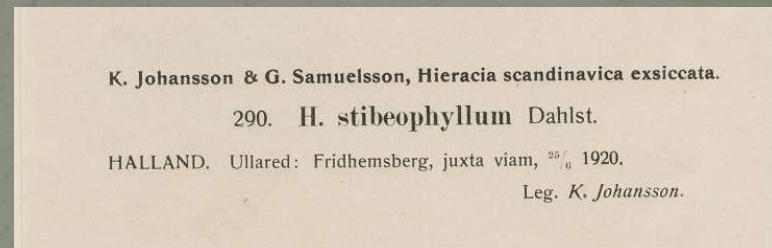


# Exsiccata: a special kind of collections



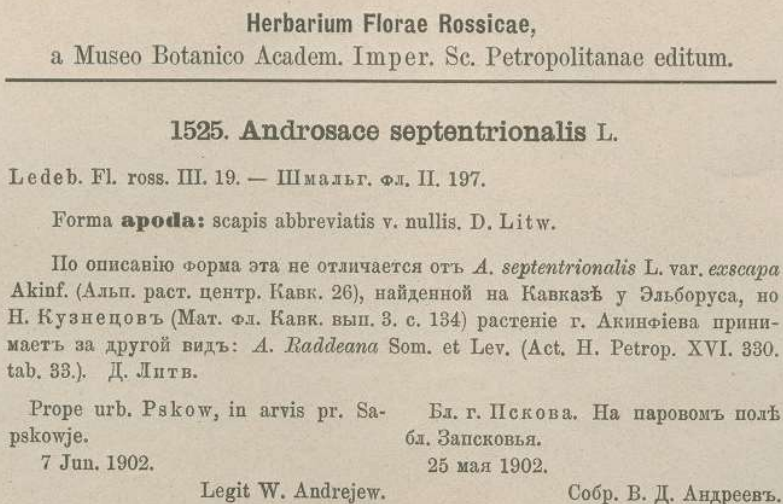
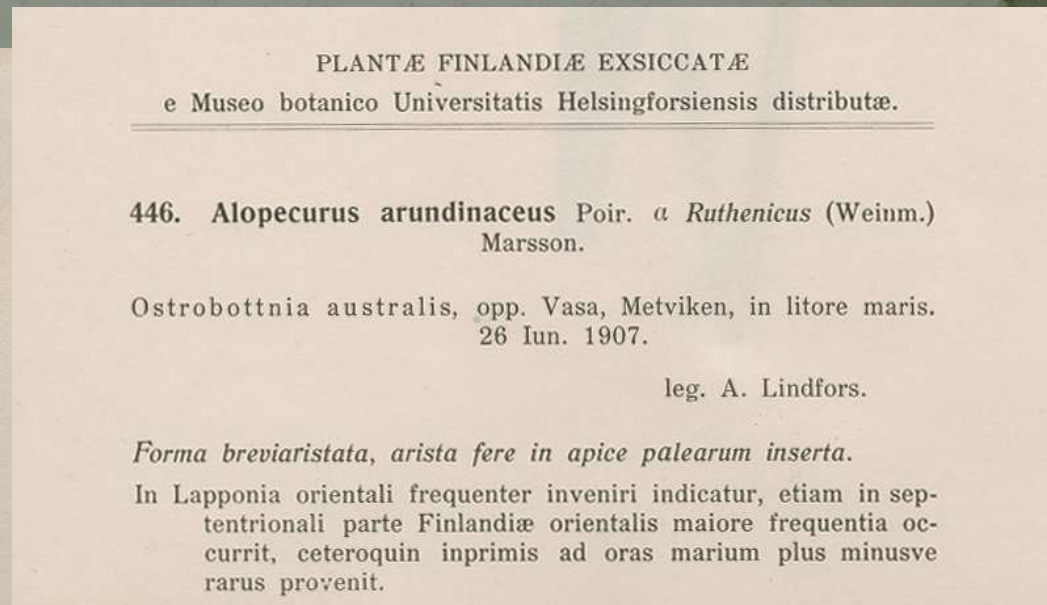
N.I.Fellman, Plantae Arcticae  
Exsiccatae (1864); 15 sets distributed

Herbarium Florae Rossicae  
(1901-present); 50 sets distributed



K.Johansson & G.Samuelsson, Hieracia  
Scandinavica exsiccata (1923-1939)

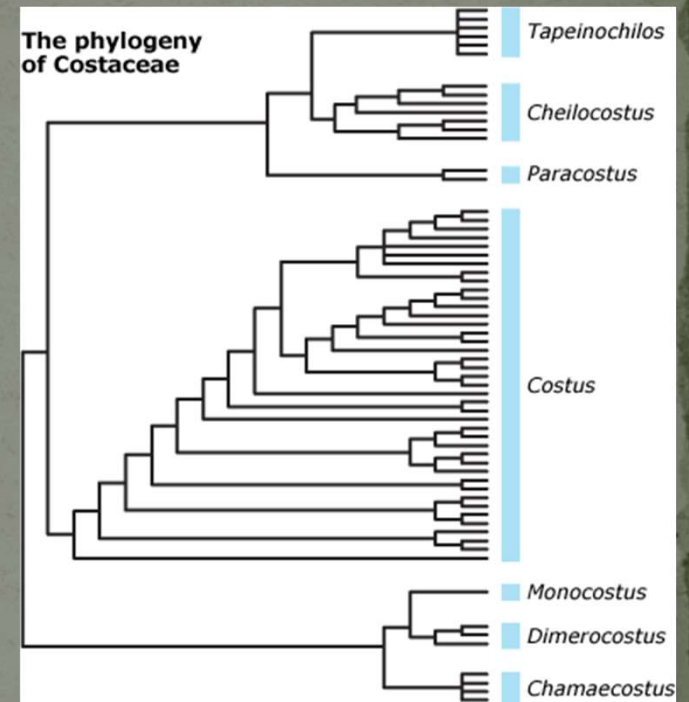
Plantae Finlandiae exsiccae (1906-1944);  
25 sets distributed



Taxonomic hierarchy  
and classification

# Hierarchy of ranks reflects phylogeny

- Hierarchy (branching) above species level is potentially endless
- Taxa are monophyletic unless reticulation occurs
- Taxon circumscription and ranking above species level is conventional
- International Code of Phylogenetic Nomenclature (“PhyloCode”) – proposal to abandon ranking and naming above species level





# Principal taxonomic ranks

- Kingdom 1789
- Division
- Classis
- Order
- Family
- **Genus** 1753
- Species (basic rank in the Code)

Each species is assignable to higher ranks but only the rank of genus is mandatory in use (principle of binomial nomenclature)

# Suprageneric ranks and names in vascular plants

Rank		Ending	Example
division/phylum	compound noun in plural	-phyta / -mycota	Magnoliophyta
subdivision/subphylum	compound substantivised adjective in plural	-phytina / -mycotina	Magnoliophytina
class	compound noun or substantivised adjective in plural	-opsida / -mycetes / -phyceae	Magnoliopsida
subclass	compound substantivised adjective in plural	-idae / -mycetidae / -phycidae	Magnoliidae
order	substantivised adjective in plural	-ales	Magnoliales
suborder	substantivised adjective in plural	-ineae	Magnoliineae
family	substantivised adjective in plural	-aceae	Magnoliaceae
subfamily	substantivised adjective in plural	-oideae	Magnolioideae
tribe	substantivised adjective in plural	-eae	Magnolieae
subtribe	substantivised adjective in plural	-inae	Magnoliinae
genus	noun or substantivised adjective	no standard	Magnolia

# Formation of suprageneric names which are not automatically typified

- Historical names alternative to those which are regularly formed:

*Compositae* (*Asteraceae*; type, *Aster* L.)

*Cruciferae* (*Brassicaceae*; type, *Brassica* L.)

*Gramineae* (*Poaceae*; type, *Poa* L.)

*Guttiferae* (*Clusiaceae*; type, *Clusia* L.)

*Labiatae* (*Lamiaceae*; type, *Lamium* L.)

*Leguminosae* (*Fabaceae*; type, *Faba* Mill. [= *Vicia* L.])

*Palmae* (*Arecaceae*; type, *Areca* L.)

*Papilionaceae* (*Fabaceae*; type, *Faba* Mill.)

*Umbelliferae* (*Apiaceae*; type, *Apium* L.)

- Descriptive names at highest ranks (traditional words without standard endings), e.g.

*Angiospermae* = *Magnoliophyta*,

*Coniferae* = *Pinopsida*,

*Gymnospermae* = *Pinophyta*.

# Index to suprageneric plant names

James Reveal, **Index to Suprageneric Names of Extant Vascular Plants**

<http://www.plantsystematics.org/reveal/pbio/fam/highaxaindex.html>

Contains lists of all suprageneric names published up to 2006 (no update available)